Walla Walla River Metering and Flow Telemetry Assessment

Walla Walla Basin Watershed Council

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Background

The Walla Walla River watershed is a bi-state watershed that originates in Oregon and passes through the state of Washington on route to its confluence with the Columbia River (Figure 1). As in many watersheds in the Western United States, the Walla Walla River basin's water quality and endangered species issues are heavily influenced by the timing, availability, quality, and quantity of water originating from both surface and ground sources.

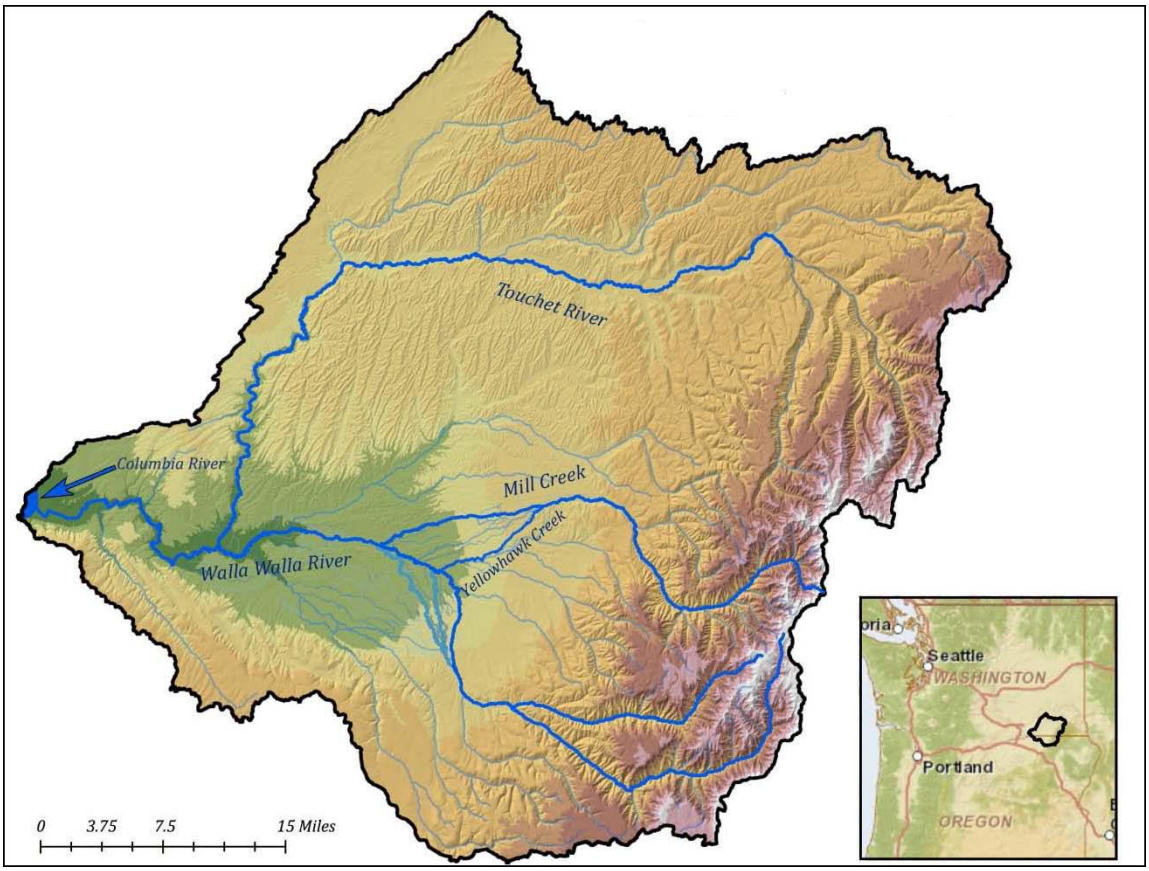

Figure 1 Walla Walla River Watershed

As there is a demand on water resources for agricultural activities there is also a demand to maintain adequate instream flows for fisheries and other wildlife. In the recent past, low flow conditions have occurred creating conditions detrimental to migrating and resident fish passage. There is a need to identify similar future low flow conditions in real-time to initiate an immediate response either by fish salvage or changes to flow conditions.

Multiple agencies within the basin conduct surface water monitoring and metering. Many of the sites are located on the main rivers and streams in the Walla Walla Basin. What's lacking is a full understanding of the amount of water being diverted out of the Walla Walla River in near-real time. To quantify the amount of water flowing in and out of the Walla Walla River a system is needed to collect and distribute the flow data in real-time.

Current Conditions

Existing Walla Walla Flow Telemetry Sites

The highly managed reaches of the Walla Walla River begin as the river flows into the Walla Walla Valley at Milton-Freewater, Oregon. One of the major diversion on the river is at the Cemetery Road Bridge where typically, in the early summer months, 75% of the available flow is diverted into the Little Walla Walla River system which feeds multiple irrigation districts. For this assessment, the focus area begins at the 15th Street (Grove School) Bridge which spans the Walla Walla River as it flows out onto the valley floor. The 15th Street Bridge site is also the location of a **Geostationary Operational Environmental Satellite** system (GOES) satellite telemetry station managed by the Walla Walla Basin Watershed Council (WWBWC), this site provides up gradient flow data for the valley.

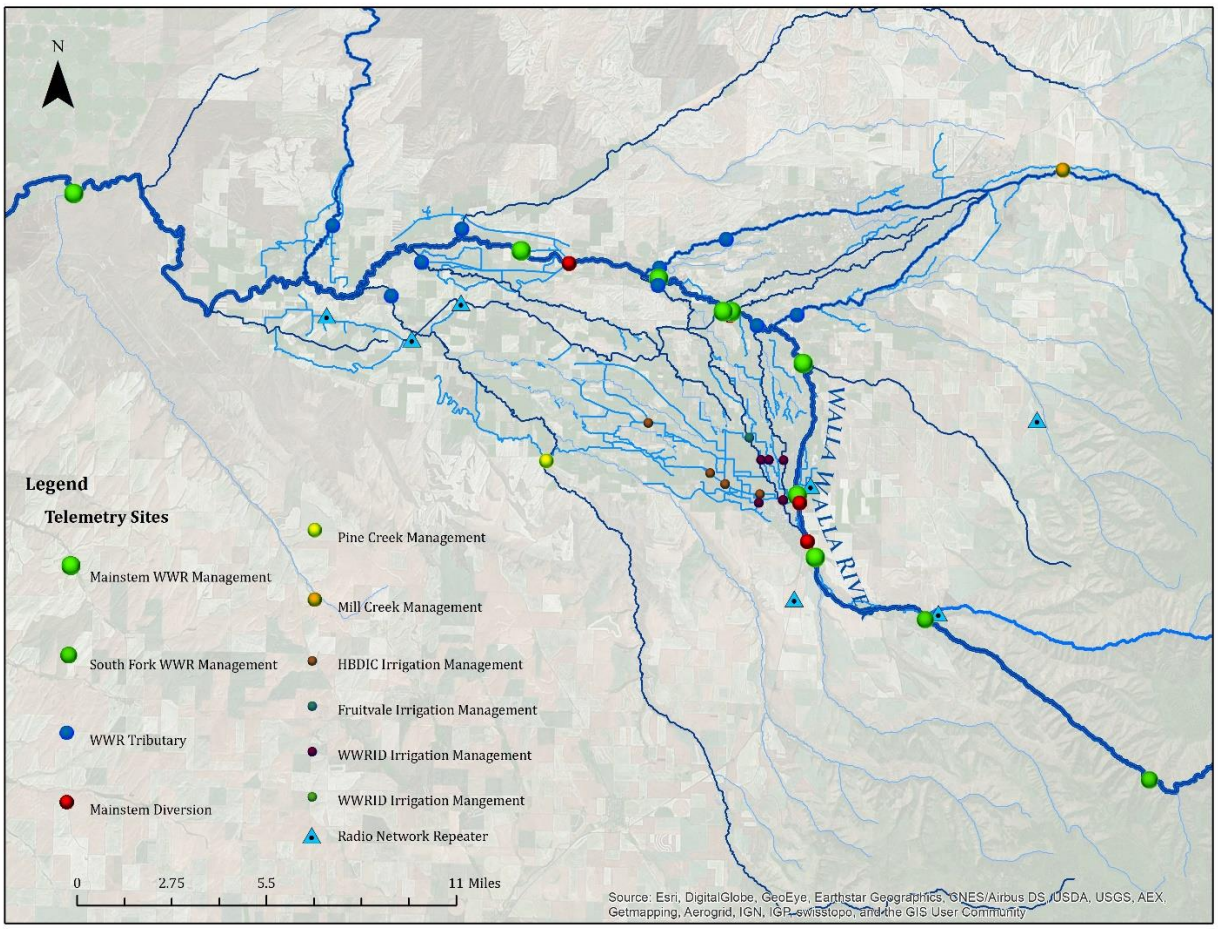

Figure 2. Existing Sites

A list of currently operating, or have been funded at the time of this report, telemetry sites vital to creating a flow managing tool for the Walla Walla River are listed below:

1. **15th Street (Grove School) Bridge (WWBWC)**
    a. GOES telemetry site which produces stage and discharge data published to the WWBWC website hourly.
    b. Quantifies the amount of available Walla Walla River at Milton-Freewater, Oregon before the major diversion at Cemetery Road Bridge.

2. **Little Walla Walla Diversion at Cemetery Road Bridge (Oregon Water Resources Department, OWRD)**
    a. GOES telemetry site which produces stage and discharge data published to the OWRD website hourly.
    b. Quantifies the amount of diverted water which flows into the Little Walla Walla.

3. **Pepper Bridge (WWBWC)**
    a. GOES telemetry site which produces stage, discharge, and water temperature data published to the WWBWC website hourly.
    b. Quantifies the amount of water flowing into the state of Washington

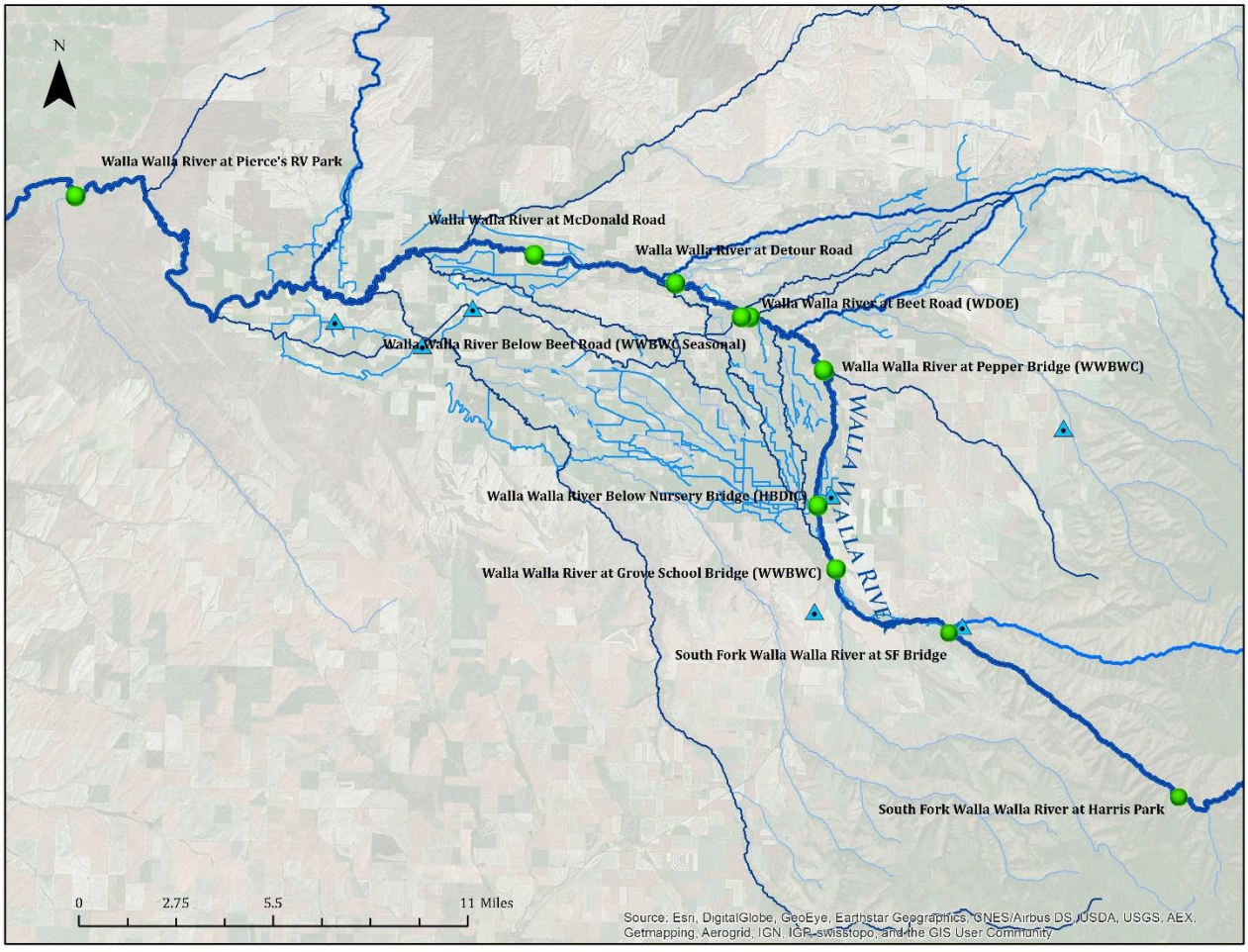

Figure 3 Mainstem Telemetry Sites 2017

4. **Yellowhawk Creek at Hwy 125 (WWBWC)**
    a. Radio Telemetry site which produces stage, discharge, and water temperature data published on the WWBWC website hourly.
    b. The station is located below the last major diversion on Yellowhawk Creek and it quantifies the amount of inflow to the Walla Walla River from Yellowhawk Creek.

5. **Beet Road Bridge (Washington Department of Ecology, WDOE)**
    a. GOES telemetry site which produces stage, discharge, water temperature, and air temperature.
    b. This site is used to determine the amount of water bypassing the GFID diversion.

6. **Beet Road Low Flow Gauge (Seasonal WWBWC)**
    a. Seasonal gauge installed in the early summer as a backup gauge due to recreational dam building at the WDOE gauge site just upstream at the Beet Road Bridge
    b. Radio Telemetry site which produces stage, discharge, and water temperature data published on the WWBWC website hourly.

7. **West Little Walla Walla River at Swegle Road (WWBWC)**
    a. Radio Telemetry site which produces stage, discharge, and water temperature data published on the WWBWC website hourly.
    b. This gauge is also used to quantify the available water in the West Little Walla Walla River for managed aquifer recharge.

8. **Mill Creek at Wallula Road (WWBWC)**
    a. Mill Creek is a major tributary to the Walla Walla River. This site is a radio telemetry site which produces stage, discharge, and water temperature data published on the WWBWC website hourly.

9. **Detour Road (WDOE)**
    a. This site is a GOES telemetry site which produces stage, discharge, and water temperature data published on the WDOE website hourly.
    b. The WDOE uses this site as a Walla Walla River regulatory site.

10. **McDonald Road (WWBWC)**
    a. This site is a cellular telemetry site that produces stage, discharge, water temperature, and air temperature data published on the WWBWC website hourly.
    b. Below the last major diversion on the Walla Walla River and identified as a critical reach due to low flow.

11. **Touchet River at Cummins Road (WDOE)**
    a. This site is a GOES telemetry site which produces stage, discharge, and water temperature data published on the WDOE website hourly.

b. Provides the Touchet River inflow into the Walla Walla River and contributes valuable flow during summer low flow season to the lower Walla Walla River.

12. USGS Touchet Gauge on the Walla Walla River (United States Geological Survey, USGS)

a. This site is a GOES telemetry site which produces stage and discharge data that is published hourly on the USGS.gov website.
b. One of the longest recording gauge stations on the Walla Walla River.

13. Pierce's RV Park Gauge (WWBWC)

a. This is the last measured location just above the point where the Walla Walla River is influenced by the Columbia River backwater. Due to its location, measurements can only be made at the site during lower flow periods due to the inability to take high flow measurements. Higher flows are calculated using modeled values from channel surveys.
b. This site is a cellular telemetry site which produces stage, discharge, and air and water temperature data which is published on the WWBWC website hourly.

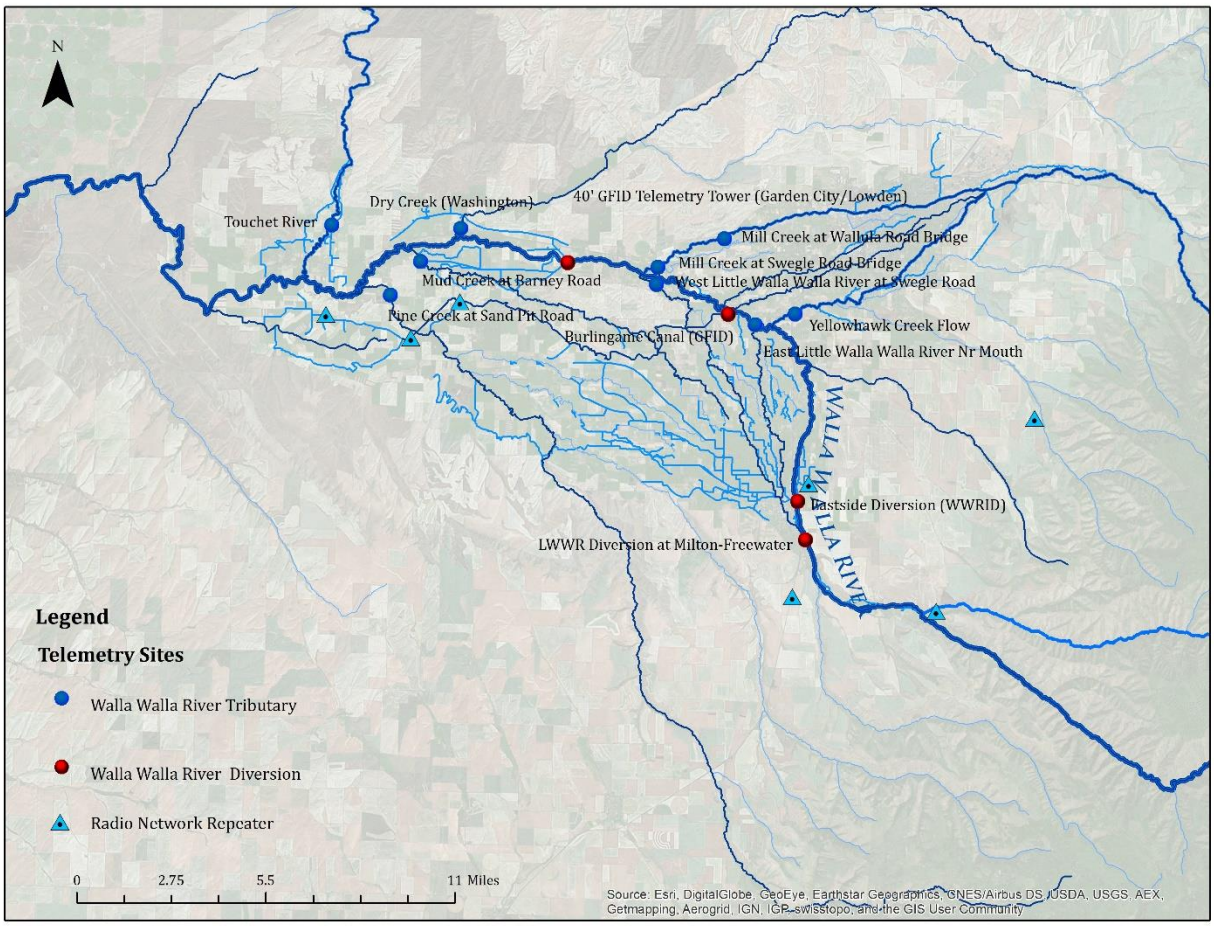

Figure 4 Mainstem tributary and diversion telemetry sites currently operational or have been funded in 2017

14. **Gardena Farms Irrigation Canal (46.022360°, -118.427973°)**
    a. Currently the GFID canal records canal flow using a pressure transducer in which the data can be accessed by dial in voice. The equipment collecting the flow data is out of date equipment which needs to be upgraded. An upgrade would consist of a new data logger along with radio telemetry equipment.
    b. This site was installed October 2015.

15. **Lowden/Garden City Ditches (46.042954°, -118.525731°)**
    a. This site is a collection of four off channel diversions located above a pneumatic dam. The ability to measure outflows in all four diversions is needed to help quantify the amount of water leaving the Walla Walla River at the site. A single data logger with associated cellular telemetry equipment is needed to collect and send diversion data to the central data base for data dissemination.
    b. The Lowden/Gardena Canal gauge site will be installed by the end of October 2017.

16. **Pine Creek (46.030853°, -118.641699°)**
    a. Lower Pine Creek contains water from both the Upper Pine Creek and the Upper Dry Creek drainages. Currently the WWBWC monitors flow with stand-alone flow stations on Dry and a real-time telemetry site on Pine Creek at Shubert Road as they flow out onto the valley floor.
    b. The WWBWC has installed a telemetry gauge on Pine Creek at Stand Pit road and are currently building a rating curve for the site. They will be publishing the data in the fall/winter of 2017.

17. **East Little Walla Walla River (46.018248°, -118.411497°)**

    a. The East Little Walla Walla River contributes approximately 10 cfs to the Walla Walla River through the summer months. The WWBWC converted its standalone monitoring station to a real-time telemetry station. The data is now being published hourly to the WWBWC, wwbwc.org.

18. **East Side Pipeline (45.944961°, -118.383848°)**
    a. The Walla Walla River Irrigation District (WWRID) manages the East Side Pipeline Diversion off the Walla Walla River above Nursery Bridge in Milton-Freewater. This diversion is located above one of the low flow reaches on the Walla Walla River. This diversion can divert approximately 5 cfs. With the Walla Walla River Irrigation District's approval, a flow station or pipe flow meter will be installed with radio telemetry equipment.
    b. The WWBWC has secured funding in 2017 to work with the WWRID to equip this site with telemetry equipment

Monitoring/Metering Gaps

The sites listed are identified locations that represent gaps in monitoring/metering where tributaries are flowing into the Walla Walla River or where diversions and pump stations are diverting water out of the river. Having a real-time understanding of flow entering or leaving the system is vital for a complete water managing program which can be used as a tool for water resource managers in the Walla Walla River Basin.

Walla Walla River

1. **Walla Walla River at Tum-A-Lum Bridge (45.976734°, -118.376477°)**
    a. During summer time low flow conditions, the reach at Tum-A-Lum Bridge provides a good indication of available flow downstream of the Milton-Freewater levee. A real-time gage station at this site would provide stage and discharge above the spring returns to the river located just downstream of this location.

2. **Dry Creek (Washington)**
    a. During the winter through late spring Dry Creek provides critical flow to a Walla Walla River. From historic data collected by the WDOE the flow at this site ranges between <1 cfs to over 50 cfs. A real-time gauge station would provide stage, discharge, and water temperature for Dry Creek near its confluence with the Walla Walla River.

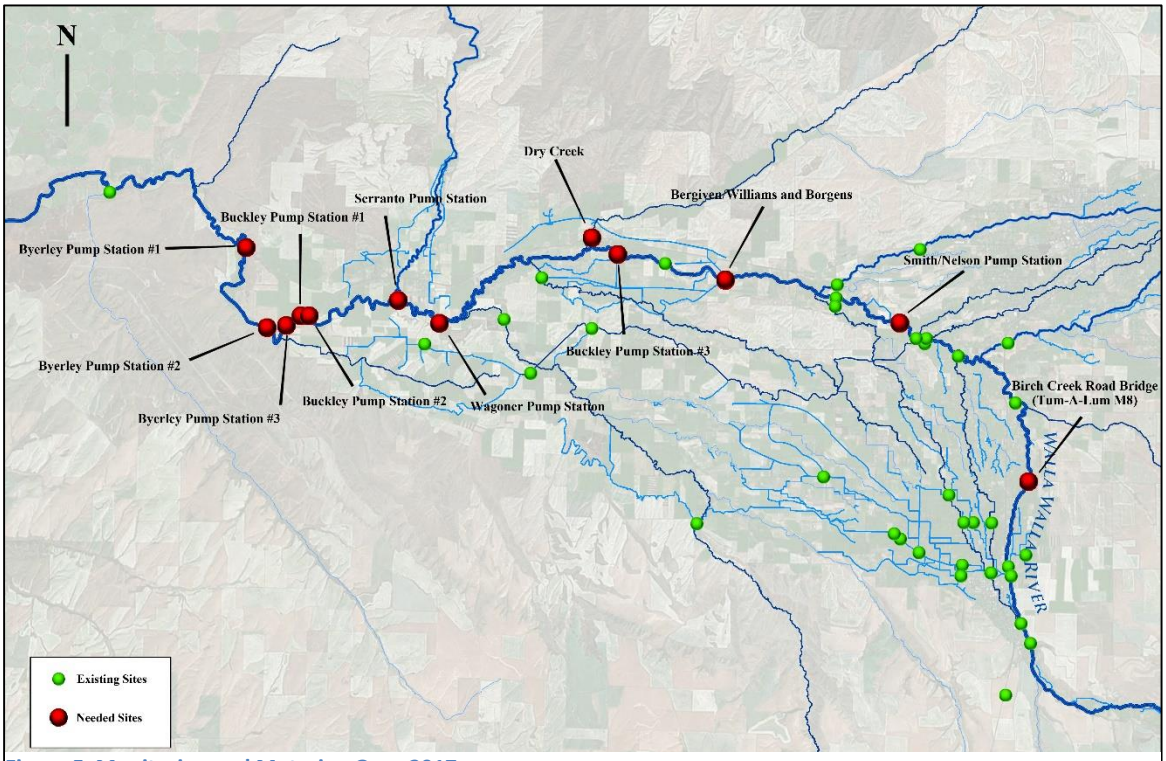

Figure 5 Monitoring and Metering Gaps 2017

Diversions and Pump Stations

1. **Bergeven/Williams (46.042954°, -118.525731°)**
    a. This site is a collection of four off channel diversions located above a pneumatic dam. The ability to measure outflows in all four diversions is needed to help quantify the amount of water leaving the Walla Walla River at the site.
    b. The Lowden/Gardena Canal gauge site will be installed by the end of October 2017.
    c. The Bergeven/Williams pipeline will need to be integrated into the telemetry.

2. **Individual Pump Stations**
    a. Listed below are pump stations with greater than 2.5 cfs on average withdrawals from the Walla Walla River. Each site would need to be assessed if the meters are capable of being used with cellular or radio telemetry. The Walla Walla County Conservation District (WWCCD) has been working with local users to retrofit pump stations with meters capable of utilizing telemetry. Due to landowner concerns from the conservation district they were not comfortable without landowner permission to divulge specific information regarding metered pump stations on the river. The first step will be to gather landowner permissions to examine each pump station to determine what type of equipment currently exists then determine what possible addition to equipment each site will need. For this assessment, the cost of setting up each pump station with telemetry equipment will assume that each site will need a new meter/data logger.

	Site Name	Surface Water Right #	Coordinates (Decimal Degrees)
1	Byerley Pump Station #1	(SW 9062)	(46.05065°, -118.75893°)
2	Byerley Pump Station #2	(SW 10191)	(46.02372°, -118.74798°)
3	Byerley Pump Station #3	(SW 3605)	(46.02457°, -118.73860°)
4	Wagoner Pump Station	(SW 1201)	(46.03390°, -118.68450°)
5	Serranto Pump Station	(SW 6523(A))	(46.02641°, -118.66425°)
6	Buckley Pump Station #1	(SW 8289)	(46.02796°, -118.73164°)
7	Buckley Pump Station #2	(SW 8130, 2849)	(46.02800°, -118.72760°)
8	Buckley Pump Station #3	(Adj. 859)	(46.05033°, -118.57849°)
9	Borgens Pump Station	(SW 7550)	(46.04306°, -118.52556°)
10	Smith/Nelson Pump Station	(various users)	(46.029833°, -118.443813°)

3. Potential Future Expansion
    a. As sites are added to the metering network additional smaller users can be added as landowner's willingness to participate increases.
    b. Expansion into the upper Walla Walla River reaches above Milton-Freewater. This assessment focused on the lower reaches of the Walla Walla River where water availability during spring and summer months is critical for fish passage and irrigation. There are numerous smaller users along with two small irrigation ditches (5 cfs and 3 cfs) in the reaches above Milton-Freewater. As the larger diversions on the lower river become integrated into a water management system focus can then be placed on the upper reaches.

Data Hosting and Distribution

Hosting data produced from multiple agencies is a challenge. Currently the WWBWC manages data from multiple agencies through providing hourly reports using Google Earth with site locations which when clicked on provide the most recently downloaded data from real-time sites and from agency sites within the basin (WWBWC Surface Water Monitoring). The drawback of providing data via hourly static reports is the inability to query data stored on differing sites.

The WWBWC uses AQUARIUS Time-Series software from Aquatic Informatics to ingest, process, and report data from remote WWBWC sites. *The software is the leading software for water data management. Its simple design delivers the latest water science and techniques in an intuitive interface. It allows water resource managers to correct and quality control time series data, build better rating curves, and derive and report on water information in real-time to meet stakeholder expectations*.[1] A component to the AQUARIUS Time-Series software is a product called WebPortal. WebPortal is a stand-alone piece of software that works in conjunction with AQUARIUS Time-Series to provide an avenue to display and query data collected from the remote sites and display the data online for distribution.

AQUARIUS WebPortal provides a live snapshot of environmental conditions, making it easy to zero-in on the most critical data. The basin water managing web page can be customized to include, for example, current flow, water quality indicators, and groundwater recharge pond levels.

[1] Aquatic Informatics Website, http://aquaticinformatics.com

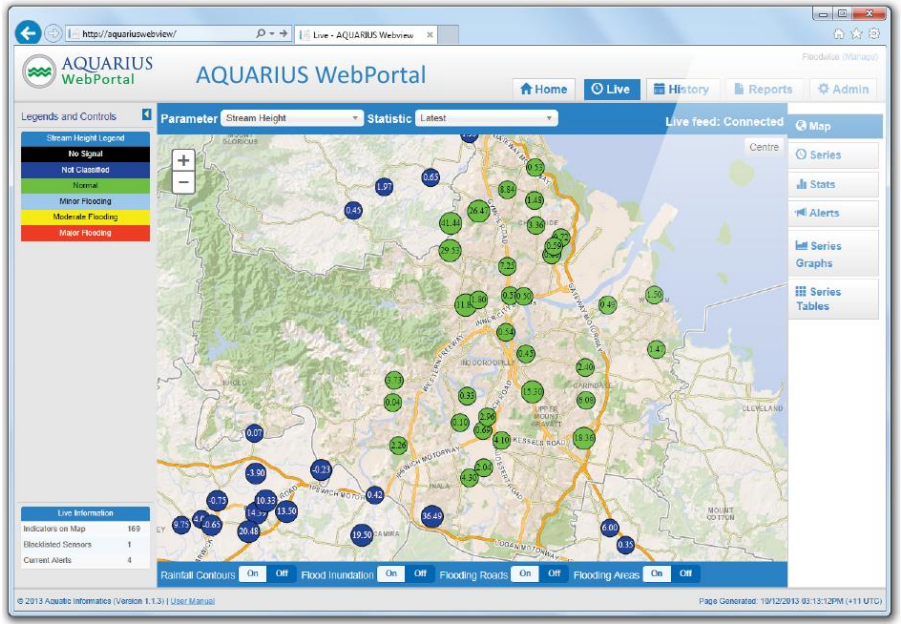

Figure 6. AQUARIUS WebPortal Display Example

WebPortal would provide interactive access to real-time data to stakeholders allowing on-demand access to quality-assured data, real-time statistics, and continuously derived computations. An interactive map allows you to zoom into the desired geography, pinpoint a location, and popup a full list of calculated statistics. You select the desired parameter (like stream flow) and statistic for primary

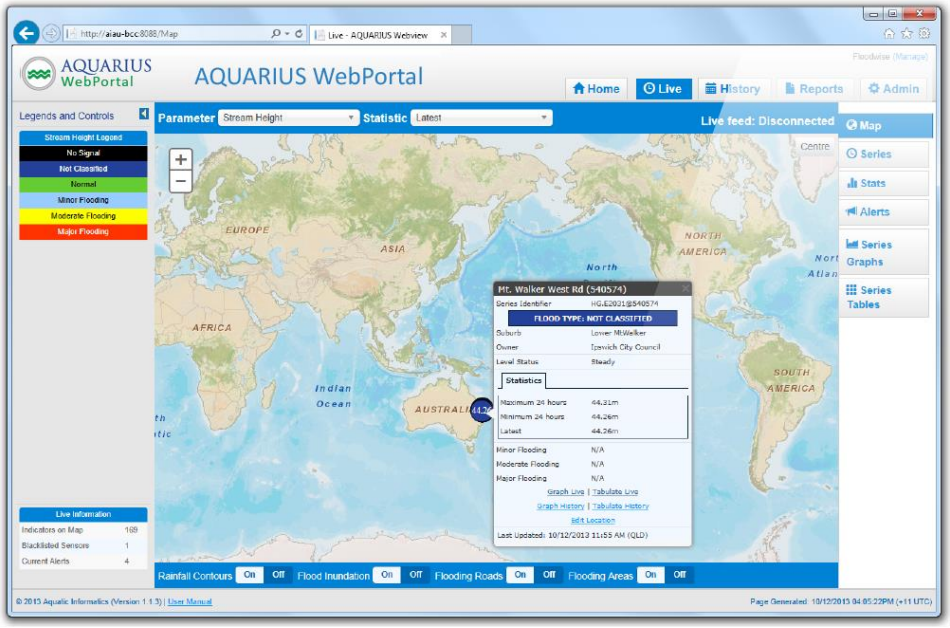

Figure 7. WebPortal Display Example

Online alerts and automatic warnings can be sent by email or Short Message Service (SMS) warn basin managers of unusual conditions. Administrative users define single- or multi-state alert triggers. When conditions are met, alert messages are sent to a predefined group of stakeholders. Trigger intervals can be set to send updates during ongoing events. When conditions normalize, a message is sent to inform recipients that the alert state has ceased.

Equipment and Costs for Telemetry Installation and Data Distribution

Installation

The WWBWC currently has a radio telemetry network which covers 90% of the Walla Walla Valley. The established network utilizes Campbell Scientific telemetry equipment. To take advantage of the established network, Campbell Scientific equipment would be used in equipping each site. The Item numbers listed in the tables below reflect the 2017 item numbers associated with the listed items in the description column.

Radio Telemetry Sites

The Items listed would be used in the installation of a spread spectrum radio telemetry site. The site will connect with an existing 900 MHz radio network administered by the WWBWC. Data will be transmitted and received using LoggerNet[2] radio administrating software by Campbell Scientific.

Item Number	Description	Quantity	Cost
CR1000	Datalogger	1	$1495.00
CS451-50	Pressure Transducer	1	$807.50
ENC- ENC14/16-SC-PM	Enclosure/ Pole Mount	1	$400.00
RF451	900 MHz Radio	1	$695.00
14221	OMNI Antenna	1	$155.00
COAXNTN-L15	Antenna Cable	1	$94.60
PS200-SW	Battery/Regulator	1	$390.00
SP20-PT-SM	20W Solar Panel	1	$295.00
MISC	Miscellaneous Installation Items	1	$300.00
		Total Per Radio Telemetry Site	$ 4632.10

Cellular Telemetry Sites

The Items listed would be used in the installation of a cellular telemetry site. The site will connect using direct data transfer using a machine to machine cellular data connection. Data will be transmitted and received using LoggerNet administrating software by Campbell Scientific.

[2] LoggerNet is Campbell Scientific's main datalogger support software package. It supports programming, communication, and data retrieval between dataloggers and a PC.

Item Number	Description	Quantity	Cost
CR1000	Datalogger	1	$1495.00
	Telemetry Flow Meter	1	$1000.00
ENC- ENC14/16-SC-PM	Enclosure/ Pole Mount	1	$400.00
RAVENXTV	CDMA Modem	1	$355.00
20679	Omni Cell Antenna	1	$175.00
COAXNTN-L15	Antenna Cable	1	$94.60
PS200-SW	Battery/Regulator	1	$390.00
SP20-PT-SM	20W Solar Panel	1	$295.00
MISC	Miscellaneous Installation Items	1	$300.00
		Total Per Cellular Telemetry Site*	$4,504.60
* Cellular telemetry site also requires a cellular data plan at $15/site for 50MB data transfer per month.			

Figure 8. Grove School GOES Telemetry Site

Total equipment cost for the installation of telemetry equipment at all the sites listed in the gap section.

Site Type	Location	Cost
Surface Flow Site (Radio Telemetry)	Walla Walla River at Tum-A-Lum Bridge	$ 4632.10
Surface Flow Site (Radio Telemetry)	Dry Creek	$4632.10

Surface Flow and Meter Site (Radio Telemetry)	Bergeven/Williams *Will use existing data logger at site	$2000.00
Meter Site (Cellular Telemetry)	Byerley Pump Station #1	$4,504.60
Meter Site (Cellular Telemetry)	Byerley Pump Station #2	$4,504.60
Meter Site (Cellular Telemetry)	Byerley Pump Station #3	$4,504.60
Meter Site (Cellular Telemetry)	Wagoner Pump Station	$4,504.60
Meter Site (Cellular Telemetry)	Serranto Pump Station	$4,504.60
Meter Site (Cellular Telemetry)	Buckley Pump Station #1	$4,504.60
Meter Site (Cellular Telemetry)	Buckley Pump Station #2	$4,504.60
Meter Site (Cellular Telemetry)	Buckley Pump Station #3	$4,504.60
Meter Site (Cellular Telemetry)	Borgens Pump Station	$4,504.60
Meter Site (Cellular Telemetry)	Smith/Nelson Pump Station	$4,504.60
Total Equipment Cost All Sites		**$56,310.20**

The total capital cost for the telemetry equipment for all the sites individually listed in the metering gap section is **$56,310.20**.

The table below reflects the cost of data collection and website data distribution through Aquatic Informatics WebPortal software, this would be a one-time investment for the purchase of the software and setup.

Item	Cost
WebPortal with web open access	$20,000.00
Technical Support	$5,000.00
Total Web Data Distribution	$25,000.00

The total capital cost for the measurement equipment, software for data distribution, and technical support is **$81,310.20.**

Station Installation Cost

The WWBWC currently has an existing network in place and the cost for the WWBWC to order and install the telemetry equipment at all those sites would total **$39,000.00**. At the time of this assessment

other bids were not collected. The cost of installation can be broken down per site at $3000/site. In creating a management tool which can be utilized by basin partners there will be additional cost of maintaining the monitoring/metering network. For surface monitoring locations site visits and manual measurements will need to occur to insure accurate data collection.

Operation and Maintenance Cost

The operations and maintenance yearly cost would cover the existing sites and the sites identified in the gaps section. The budgeted amount would cover the replacement cost for potential equipment failures, seasonal cross-sectional flow measurements needed for rating table adjustments, data analysis and reporting, and the cellular data plan.

Item	Cost
Site Maintenance and cellular data plan	$5000.00/year
Battery Replacement	$1000.00/year
Field Measurements and Data Analysis	69,000.00/year
Total Operations and Maintenance	$75,000.00/year

Summary

To manage the water resources of the Walla Walla River in real-time, gaps in metering or surface flow monitoring needs to be addressed. In this assessment thirteen sites have been identified for inclusion in the existing local monitoring network. An initial investment of $120,310.20 will be necessary to install or upgrade existing sites to fill all the identified gaps.

Telemetry and Measurement Equipment *		$56,310.20
Software, Web Processing, and Reporting		$25,000.00
Equipment Installation and Setup (WWBWC)		$39,000.00
Total Installation Cost		**$120,310.20**

*Cost for all sites listed in the gaps section

If appropriate the installation of the new sites can be phased in on a site by site basis. Although there is an initial financial investment in the network, once the sites are up and operating there will be an additional operations and maintenance cost of **$75,000/year** to keep the network operational. In the future, it will be imperative that to keep the management tool operational, funding sources are secured for the operation and maintenance of the network.